CLAIMS

[1]   An audio signal encoding device which encodes original sound signals of respective channels into downmix signal information and auxiliary information, the downmix signal information indicating an overall characteristic of the original sound signals, and the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said device comprising:

a downmix signal encoding unit operable to encode a downmix signal acquired by downmixing the original sound signals so as to generate the downmix signal information; and

an auxiliary information generation unit operable to: calculate the amount of characteristic based on the original sound signals; when channel information indicating reproduction locations, as seen by a listener, of sounds of respective channels is given, determine an encoding method that differs depending on a location relation of the reproduction locations indicated in the given channel information; and generate the auxiliary information by encoding the calculated amount of characteristic using the determined encoding method.

[2]   The audio signal encoding device according to Claim 1,

wherein said auxiliary information generation unit is operable to retain tables in advance, each table defining quantization points at which different quantization precisions are achieved, and

said auxiliary information generation unit is operable to encode the amount of characteristic by quantizing the amount of characteristic at the quantization points defined by one of the tables which corresponds to the location relation of the reproduction locations indicated in the channel information.

[3]   The audio signal encoding device according to Claim 1,

wherein said auxiliary information generation unit is operable

to calculate, as the amount of characteristic, at least one of a level difference and a phase difference between the original sound signals.

[4]   The audio signal encoding device according to Claim 3, wherein said auxiliary information generation unit is operable to calculate both of the level difference and the phase difference between the original sound signals, and to calculate, as the amount of characteristic, a direction of an acoustic image presumed to be perceived by the listener, based on the calculated level difference and phase difference.

[5]   The audio signal encoding device according to Claim 3, wherein said auxiliary information generation unit is operable to retain a first table and a second table in advance, the first table defining quantization points provided laterally symmetrical seen from a front face direction of the listener, and the second table defining quantization points provided longitudinally asymmetrical seen from a left direction of the listener, and

said auxiliary information generation unit is operable to encode the amount of characteristic (a) by quantizing the amount of characteristic at the quantization points defined by the first table, in the case where the channel information indicates front left and front right of the listener, and (b) by quantizing the amount of characteristic at the quantization points defined by the second table, in the case where the channel information indicates front left and rear left of the listener.

[6]   The audio signal encoding device according to Claim 1, wherein said auxiliary information generation unit is operable to calculate, as the amount of characteristic, a degree of similarity between the original sound signals.

[7]   The audio signal encoding device according to Claim 6,

wherein said auxiliary information generation unit is operable to calculate, as the degree of similarity, one of a cross-correlation value between the original sound signals and an absolute value of the cross-correlation value.

[8]   The audio signal encoding device according to Claim 6,

wherein said auxiliary information generation unit is operable to calculate, as the amount of characteristic, at least one of a perceptual broadening and a perceptual distance of an acoustic image presumed to be perceived by the listener, based on the calculated degree of similarity.

[9]   An audio signal decoding device which decodes downmix signal information and auxiliary information into reproduction signals of respective channels, the downmix signal information indicating an overall characteristic of original sound signals of the respective channels, and the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said device comprising:

a decoding method switching unit operable to determine, when channel information indicating reproduction locations, as seen by a listener, of sounds from the respective channels is given, a decoding method that differs depending on a location relation of the reproduction locations indicated in the given channel information;

an inter-signal information decoding unit operable to decode the auxiliary information into the amount of characteristic using the determined decoding method; and

a signal synthesizing unit operable to generate the reproduction signals of the respective channels, using the downmix signal information and the decoded amount of characteristic.

[10] The audio signal decoding device according to Claim 9,

wherein the auxiliary information is encoded by quantizing the amount of characteristic at quantization points defined by a table corresponding to the location relation of the reproduction locations indicated in the channel information, the table being one of tables, each defining quantization points at which different quantization precisions are achieved,

said inter-signal information decoding unit is operable to retain the tables in advance, and

said inter-signal information decoding unit is operable to decode the auxiliary information into the amount of characteristic using one of the tables which corresponds to the location relation of the reproduction locations indicated in the channel information.

[11] The audio signal decoding device according to Claim 10,

wherein the amount of characteristic indicates at least one of a level difference, phase difference between the original sound signals, and a direction of an acoustic image presumed to be perceived by the listener,

said inter-signal information decoding unit is operable to retain a first table and a second table in advance, the first table defining quantization points provided laterally symmetrical seen from a front face direction of the listener, and the second table defining quantization points provided longitudinally asymmetrical seen from a left direction of the listener, and

said inter-signal information decoding unit is operable to decode the auxiliary information (a) into the amount of characteristic using the first table, in the case where the channel information indicates front left and front right of the listener, and (b) into the amount of characteristic using the second table, in the case where the channel information indicates front left and rear left of the listener.

[12]   The audio signal decoding device according to Claim 9,

wherein the amount of characteristic indicates at least one of a level difference, a phase difference and a similarity between the original sound signals, and a direction of an acoustic image, a

5   perceptual broadening and a perceptual distance which are presumed to be perceived by the listener.

[13]   The audio signal decoding device according to Claim 12,

wherein said signal synthesizing unit is operable to generate

10   the reproduction signal, in the case where the amount of characteristic indicates at least one of the level difference, phase difference and similarity between the original sound signals, by applying a level difference, a phase difference and a similarity which correspond to the amount of characteristic, to a sound signal

15   indicated by the downmix signal information.

[14]   An audio signal encoding method for encoding original sound signals of respective channels into downmix signal information and auxiliary information, the downmix signal information indicating an

20   overall characteristic of the original sound signals, and the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said method comprising:

a downmix signal encoding step of generating the downmix

25   signal information by encoding a downmix signal acquired by downmixing the original sound signals; and

an auxiliary information generation step of: calculating the amount of characteristic based on the original sound signals; when channel information indicating reproduction locations, as seen by a

30   listener, of sounds of the respective channels, determining an encoding method that differs depending on a location relation of the reproduction locations indicated in the given channel information;

and generating the auxiliary information by encoding the calculated amount of characteristic using the determined encoding method.

[15]   An audio signal decoding method for decoding downmix signal information and auxiliary information into reproduction signals of respective channels, the downmix signal information indicating an overall characteristic of the original sound signals of the respective channels, the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said method comprising:

a decoding method switching step of determining, when channel information indicating reproduction locations, as seen by a listener, of sounds of the respective channels is given, a decoding method that differs depending on a location relation of reproduction locations indicated in the given channel information;

an inter-signal information decoding step of decoding the auxiliary information into the amount of characteristic using the determined decoding method; and

a signal synthesizing step of generating reproduction signals of the respective channels using the downmix signal information and the decoded amount of characteristic.

[16]   A computer executable program for encoding original sound signals of respective channels into downmix signal information and auxiliary information, the downmix signal information indicating an overall characteristic of the original sound signals, and the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said program comprising:

a downmix signal encoding step of generating the downmix signal information by encoding a downmix signal acquired by downmixing the original sound signals; and

an auxiliary information generation step of: calculating the amount of characteristic based on the original sound signals; when channel information indicating reproduction locations, as seen by a listener, of sounds of the respective channels is given, determining an encoding method that differs depending on a location relation of the reproduction locations indicated in the given channel information; and generating the auxiliary information by encoding the calculated amount of characteristic using the determined encoding method.

[17] A computer executable program for decoding downmix signal information and auxiliary information into reproduction signals of respective channels, the downmix signal information indicating an overall characteristic of the original sound signals of the respective channels, the auxiliary information indicating an amount of characteristic based on a relation between the original sound signals, said program comprising:

a decoding method switching step of determining, when channel information indicating reproduction locations, as seen by a listener, of sounds of the respective channels is given, a decoding method that differs depending on a location relation of reproduction locations indicated in the given channel information;

an inter-signal information decoding step of decoding the auxiliary information into the amount of characteristic using the determined decoding method; and

a signal synthesizing step of generating reproduction signals of the respective channels using the downmix signal information and the decoded amount of characteristic.

[18] A computer readable recording medium on which the program according to at least one of Claim 16 and Claim 17 is stored.